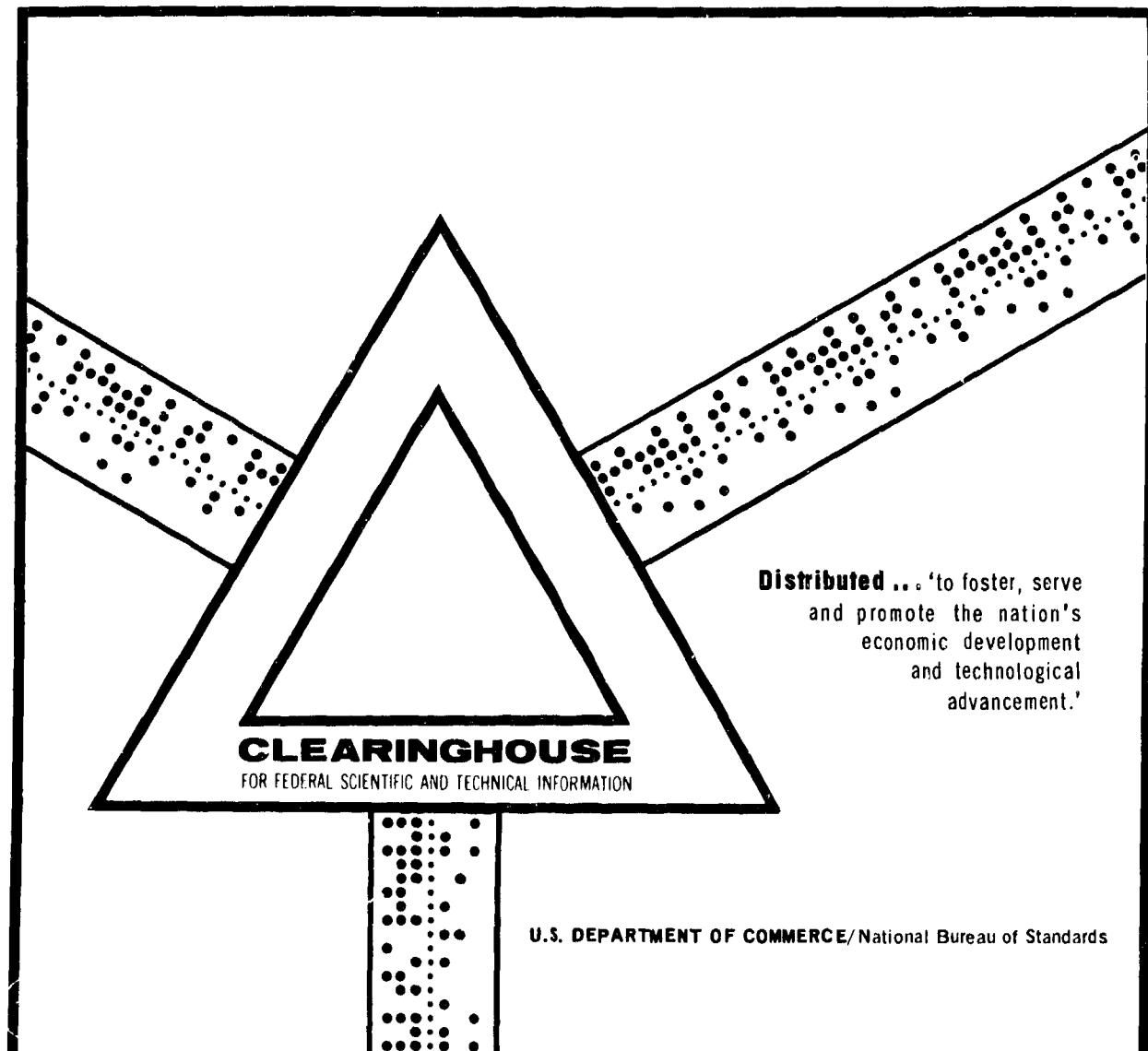


A D 700 075

MECHANICAL-PROPERTY DATA 7049 ALUMINUM: T73
FORGINGS.

Battelle Memorial Institute
Columbus, Ohio

December 1969



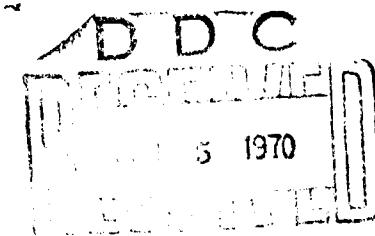
This document has been approved for public release and sale.

AD700075

MECHANICAL-PROPERTY DATA 7049 ALUMINUM

T73 Forgings

Issued by



Air Force Materials Laboratory
Air Force Systems Command
Wright-Patterson Air Force Base, Ohio

December, 1969

Prepared by

Battelle Memorial Institute
Columbus Laboratories
Columbus, Ohio 43201

F33615-69-C-1115

Reproduced by the
CLEARINGHOUSE
for Federal Scientific & Technical
Information Springfield, Va. 22151

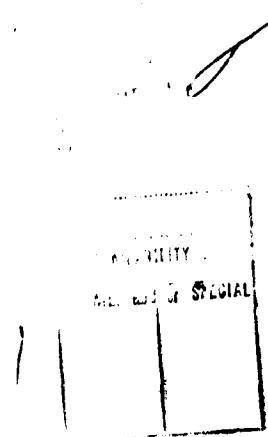
This data sheet was prepared by Battelle Memorial Institute under Contract F33615-69-C-1115. The contract was initiated under Project No. 7381, "Materials Application", Task No. 738106, "Engineering and Design Data". The major objectives of this program are to evaluate newly developed structural materials of potential Air Force weapons-system interest and then to provide data-sheet-type presentations of these data. The program was assigned to the Structural Materials Engineering Division at Battelle under the technical supervision of Mr. Walter S. Hyler. Project engineer was Mr. Omar Deel. The program was administered under the direction of the Air Force Materials Laboratory, Air Force Systems Command, Wright-Patterson Air Force Base, Ohio, by Mr. Marvin Knight, project engineer.

Notices

When Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely related Government procurement operation, the United States Government thereby incurs no responsibility nor any obligation whatsoever; and the fact that the government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data, is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented invention that may be in any way related thereto.

This document has been approved for public release and sale; its distribution is unlimited.

Copies of this report should not be returned unless return is required by security considerations, contractual obligations, or notice on a specific document.



7049-T73

Alloy X7049 is a new development by Kaiser Aluminum and Chemical Corporation. It was designed to have a strength level in the range of 7075-T6 and 7079-T6, coupled with a high resistance to stress-corrosion cracking. The temper designation -T73 has been assigned to cover the alloy with these characteristics. The initial development and production has been in the form of die forgings and hand forgings.

The threshold level for stress-corrosion cracking is reported by Kaiser to be 45 ksi.

All specimens used for this test program were from a 5-inch-thick forging. The composition of this forging is as follows:

Si	0.07
Fe	0.13
Mn	0.01
Cu	1.48
Mg	2.45
Cr	0.16
Zn	7.50
Al	Balance

7049 DATA^(a)Condition: T73
Thickness: 5-Inch Forging

Properties	RT	Temperature, F		
		250	350	500
<u>Tension</u>				
F_{tu} (longitudinal), ksi	72.9	62.2	49.7	16.7
F_{tu} (transverse), ksi	74.9	62.3	50.3	18.1
F_{tu} (short transverse), ksi	70.9	--	--	--
F_{ty} (longitudinal), ksi	64.2	59.7	49.0	16.6
F_{ty} (transverse), ksi	66.5	60.1	49.5	18.0
F_{ty} (short transverse), ksi	61.9	--	--	--
e_t (longitudinal), percent in 2 in.	8.8	14.8	20.0	29.3
e_t (transverse), percent in 2 in. n	11.0	15.7	18.0	30.0
e_t (short transverse), percent in 2 in.	6.0	--	--	--
E_t (longitudinal), 10^6 psi	10.2	9.9	8.8	7.1
E_t (transverse), 10^6 psi	10.6	10.2	8.2	6.9
E_t (short transverse), 10^6 psi	9.9	--	--	--
<u>Compression</u>				
F_{cy} (longitudinal), ksi	66.8	64.0	53.3	4
F_{cy} (transverse), ksi	67.6	63.0	51.9	19.7
E_c (longitudinal), 10^6 psi	10.6	9.4	8.4	8.2
E_c (transverse), 10^6 psi	10.6	9.9	8.6	7.9
<u>Shear^(b)</u>				
F_{su} , (longitudinal), ksi	47.8	U	U	U
F_{su} , (transverse), ksi	47.7	U	U	U
<u>Impact</u> (V-notch charpy), ft-lb	4.1 ^(c)	U	U	U
<u>Fracture Toughness</u> , K_{Ic} , ksi $\sqrt{\text{in.}}$	31.7	(d)	U	U

Properties	Temperature, F			
	RT	250	350	500
<u>Axial Fatigue (Transverse)(e)</u>				
Unnotched, $R = 0.1$				
10^3 cycles, ksi	73	71	70	--
10^5 cycles, ksi	57	53	48	--
10^7 cycles, ksi	46	40	38	--
Notched ($K_t = 3.0$), $R = 0.1$				
10^3 cycles, ksi	50	50	50	--
10^5 cycles, ksi	21	20	19	--
10^7 cycles, ksi	16	13	11	--
<u>Creep (Transverse)</u>				
0.2% plastic deform. in 100 hr, ksi	NA	42	15	4
0.2% plastic deformation 1000 hr, ksi	NA	36	9	2.7
<u>Stress Rupture (Transverse)</u>				
Rupture 100 hr, ksi	NA	50	21	5.6
Rupture 1000 hr, ksi	NA	40	13.5	4.3
<u>Stress Corrosion</u>				
80% F_{ty} , 1000 hr max		No cracks(f)		
<u>Coefficient of Thermal Expansion</u>				
13.0×10^{-6} in./in./F (RT to 212 F)				
<u>Density</u> 0.099 lb/in. ³				

(a) Data are average of triplicate tests conducted at Battelle unless otherwise indicated. Fatigue, creep, and stress-rupture values are from data curves generated using a greater number of tests.

(b) Double-shear pin-type specimen, 1/2-inch diameter.

(c) 4.1 at RT, 3.5 at -100 F, 3.2 at -320 F.

(d) Average of six chevron-notched slow-bend tests. Tests at 250 F proved to be invalid.

(e) "R" represents the algebraic ratio of minimum to maximum stress in one cycle; that is, $R = S_{min}/S_{max}$. "K_t" represents the Neuber-Peterson theoretical stress-concentration factor.

(f) Three-point bend test. Alternate immersion in 3-1/2 percent NaCl.

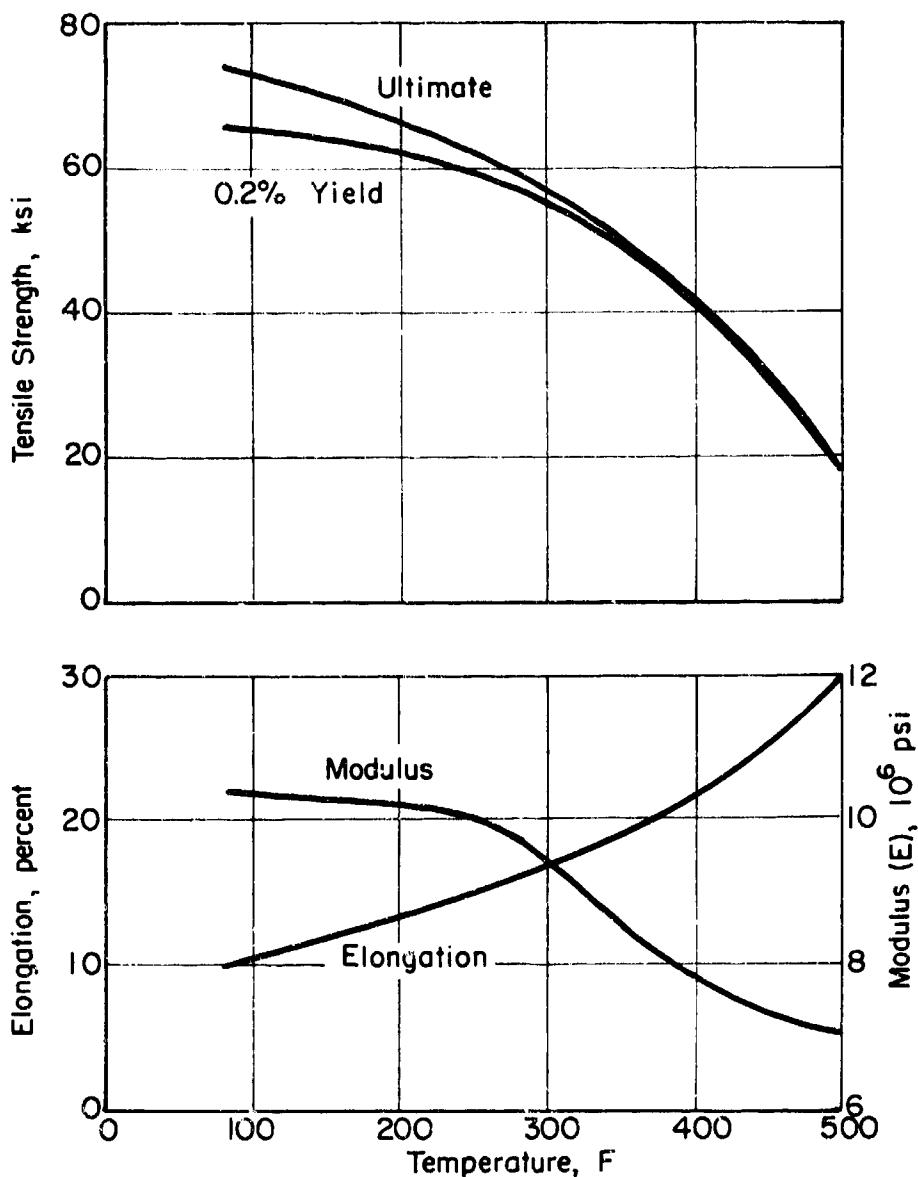


FIGURE 1. EFFECT OF TEMPERATURE ON THE TENSILE PROPERTIES OF 7049-T73 ALUMINUM FORGINGS

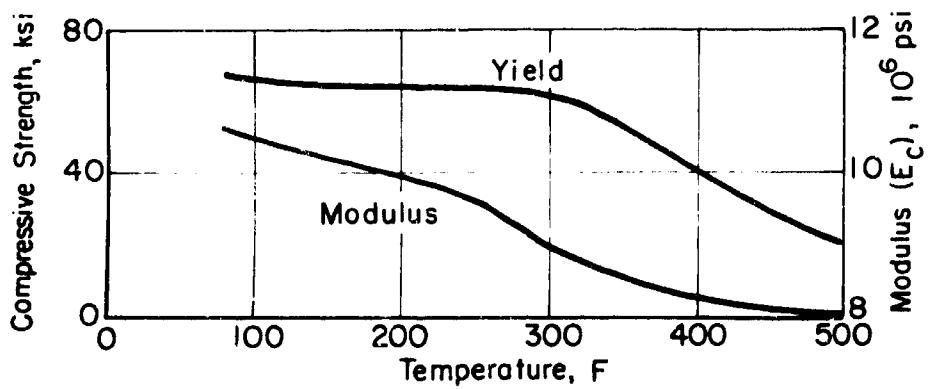


FIGURE 2. EFFECT OF TEMPERATURE ON THE COMPRESSION PROPERTIES OF 7049-T73 ALUMINUM FORGINGS

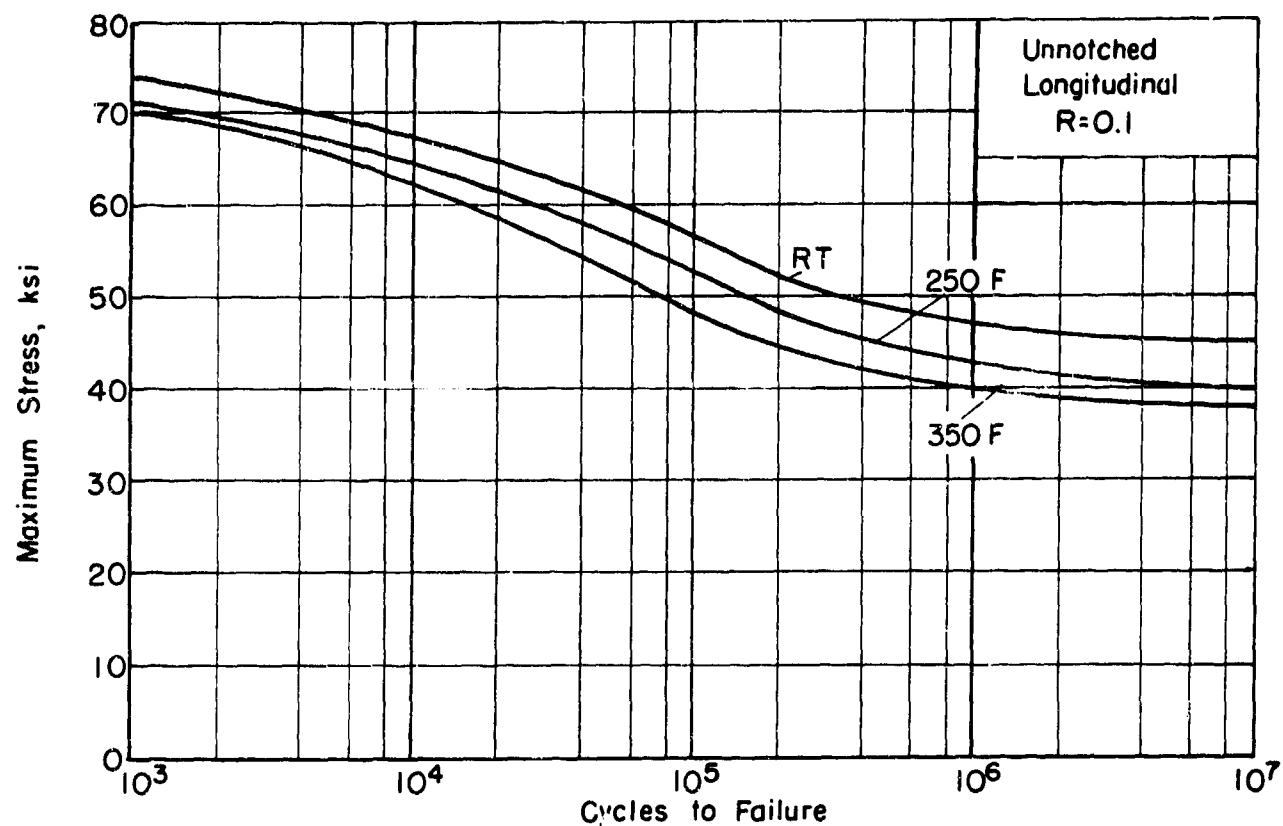


FIGURE 3. AXIAL-LOAD FATIGUE RESULTS FOR UNNOTCHED 7049-T73 ALUMINUM FORGING AT THREE TEMPERATURES

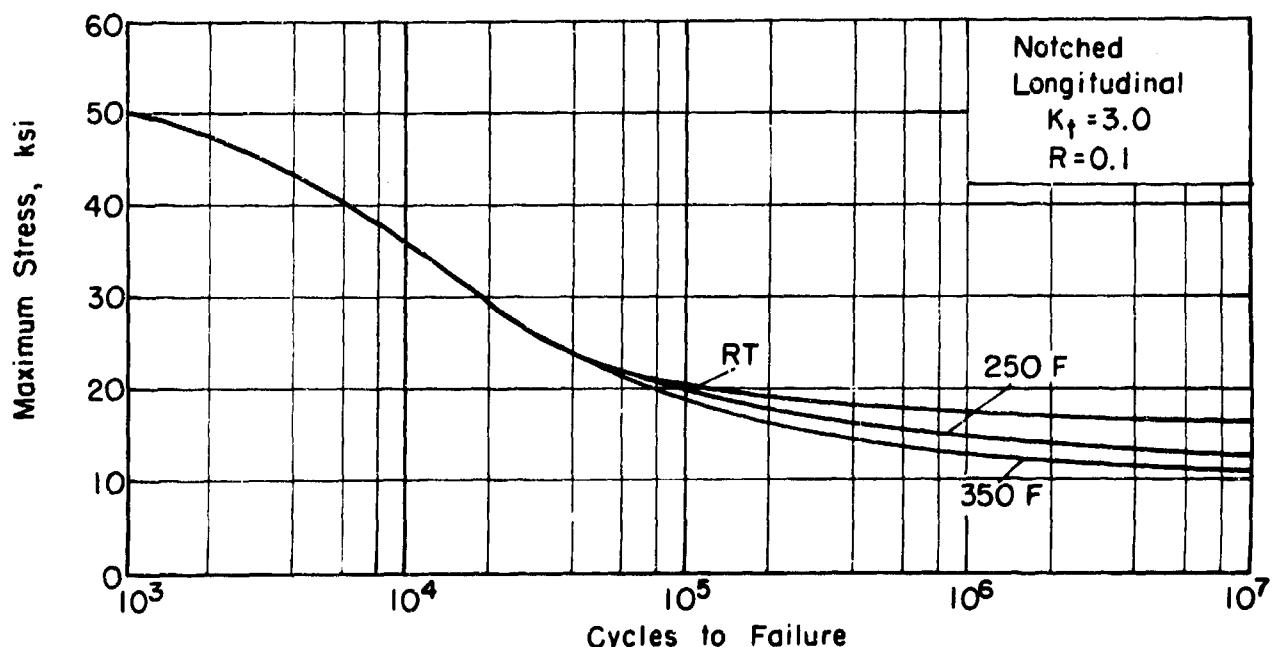


FIGURE 4. AXIAL-LOAD FATIGUE RESULTS FOR NOTCHED ($K_t = 3.0$) 7049-T73 ALUMINUM FORGING AT THREE TEMPERATURES

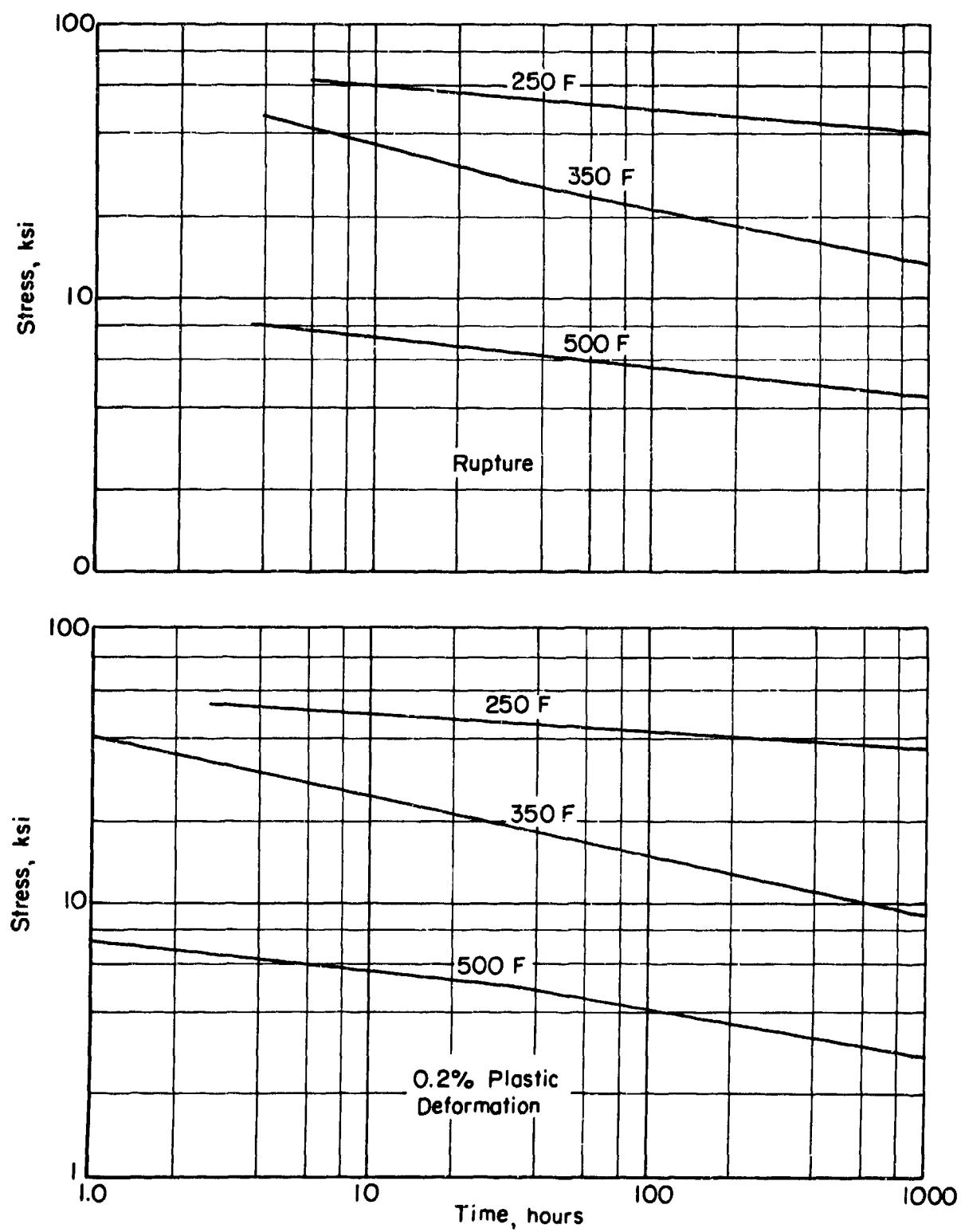


FIGURE 5. STRESS-RUPTURE AND PLASTIC-DEFORMATION CURVES FOR 7049-T73 ALUMINUM FORGINGS